AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A communication quality measuring method in CDMA cellular system detecting a reception chip timing of a channel to be measured and measuring communication quality, comprising:

time series generating step of generating two series of data consisted of a time series data of a detected value and a time series data delayed for one, two or more periods, with respect to said reception chip timing where the detected value becomes the same;

matrix calculation step of deriving covariant matrix of said two series data generated in said time series generating step;

first power calculating step of deriving a desired signal power and an interference signal power in said reception chip timing from a eigenvalue of said covariant matrix; and

signal to interference power ratio (SIR) calculating step deriving a SIR at said reception chip timing from said desired signal power and said interference signal power.

2. (Original) A communication quality measuring method in CDMA cellular system as claimed in claim 1, which further comprises

third power calculation step of deriving an averaged desired signal power and an averaged interference signal power by performing averaging in a given period from said desired signal power and said interference signal power obtained in said first power calculation step and a second power calculation step, and

in said SIR calculation step, said SIR is derived from said averaged desired signal power and said averaged interference signal power.

3. (Original) A communication quality measuring method in CDMA cellular system as claimed in claim 2, wherein when the channel to be measured is plural and only one correlation detector is useful,

in said third power calculating step, said averaged desired signal power and said average interference signal power are derived in time division, and

in said SIR calculation step, said SIR of a plurality of channels are derived in time division.

4. (Original) A communication quality measuring method in CDMA cellular system as claimed in claim 1, wherein when the channel to be measured is plural and only one correlation detector is useful,

correlation detection of a plurality of channels is performed in time division for generating two series generated in the same reception chip timing per channel.

5. (Original) A communication quality measuring method in CDMA cellular system as claimed in claim 4, which further comprises

fourth power calculation step of deriving an averaged desired signal power and an averaged interference signal power by averaging a given period from said desired signal power and said interference signal power obtained in said first power calculation step and a second power calculation step, and

in said SIR calculation step, said SIR is derived from said averaged desired signal power and said averaged interference signal power.

6. (Original) A communication quality measuring method in CDMA cellular system as claimed in claim 1, which further comprises:

path detection step of deriving paths between transmitter and receiver to be effective for communication from a value of said SIR obtained in said SIR calculation step.

7 (Currently Amended) A communication quality measuring method in CDMA cellular system detecting a reception chip timing of a channel to be measured and measuring communication quality, comprising:

time series generating step of generating two series of data consisted of a time series data of a detected value and a time series data delayed for one, two or more periods, with respect to said reception chip timing where the detected value becomes the same;

adding step of deriving an add vector from addition of received signal vectors between two points close in reception timing when said two series data generated in said time series generating step becomes a particular correlation value;

subtracting step of deriving a difference vector from a difference of received signal vectors between two points close in reception timing;

second power calculation step of deriving a desired signal power and an interference signal power by averaging said add vectors and said difference vectors; and

signal to interference power ratio (SIR) calculating step deriving a SIR at said reception chip timing from said desired signal power and said interference signal power.

8. (Original) A communication quality measuring method in CDMA cellular system as claimed in claim 7, which further comprises

third power calculation step of deriving an averaged desired signal power and an averaged interference signal power by performing averaging in a given period from said desired signal power and said interference signal power obtained in a first power calculation step and said second power calculation step, and

in said SIR calculation step, said SIR is derived from said averaged desired signal power and said averaged interference signal power.

9. (Original) A communication quality measuring method in CDMA cellular system as claimed in claim 8, wherein when the channel to be measured is plural and only one correlation detector is useful,

in said third power calculating step, said averaged desired signal power and said average interference signal power are derived in time division, and

in said SIR calculation step, said SIR of a plurality of channels are derived in time division.

10. (Original) A communication quality measuring method in CDMA cellular system as claimed in claim 7, wherein when the channel to be measured is plural and only one correlation detector is useful,

correlation detection of a plurality of channels are performed in time division for generating two series generated in the same reception chip timing per channel.

11. (Original) A communication quality measuring method in CDMA cellular system as claimed in claim 10, which further comprises

fourth power calculation step of deriving an averaged desired signal power and an averaged interference signal power by averaging a given period from said desired signal power and said interference signal power obtained in said first power calculation step and a second power calculation step, and

in said SIR calculation step, said SIR is derived from said averaged desired signal power and said averaged interference signal power.

12. (Original) A communication quality measuring method in CDMA cellular system as claimed in claim 7, which further comprises:

path detection step of deriving paths between transmitter and receiver to be effective for communication from a value of said SIR obtained in said SIR calculation step.

13. (Currently Amended) A communication quality measuring apparatus in CDMA cellular system detecting a reception chip timing of a channel to be measured and measuring communication quality, comprising:

time series generating means for generating two series of data consisted of a time series data of a detected value and a time series data delayed for one, two or more periods, with respect to said reception chip timing where the detected value becomes the same;

matrix calculation means for deriving covariant matrix of said two series data generated in said time series generating means;

first power calculating means for deriving a desired signal power and an interference signal power in said reception chip timing from eigenvalues of said covariant matrix; and

signal to interference power ratio (SIR) calculating means deriving a SIR at said reception chip timing from said desired signal power and said interference signal power.

14. (Original) A communication quality measuring apparatus in CDMA cellular system as claimed in claim 13, which further comprises:

third power calculation means for deriving an averaged desired signal power and an averaged interference signal power by performing averaging in a given period from said desired signal power and said interference signal power obtained in said first power calculation means and a second power calculation means.

15. (Original) A communication quality measuring apparatus in CDMA cellular system as claimed in claim 14, wherein when the channel to be measured is plural and only one correlation detector is useful,

said third power calculating means derives said averaged desired signal power and said average interference signal power in time division, and

said SIR calculation means derives said SIR of a plurality of channels in time division.

16. (Original) A communication quality measuring apparatus in CDMA cellular system as claimed in claim 13, wherein when the channel to be measured is plural and only one correlation detector is useful,

correlation detection of a plurality of channels is performed in time division for generating two series generated in the same reception chip timing per channel.

17. (Original) A communication quality measuring apparatus in CDMA cellular system as claimed in claim 16, which further comprises:

fourth power calculation means for deriving an averaged desired signal power and an averaged interference signal power by averaging a given period from said desired signal power and said interference signal power obtained in said first power calculation means and a second power calculation means.

18. (Original) A communication quality measuring apparatus in CDMA cellular system as claimed in claim 13, which further comprises

path detection means for deriving a path between transmitter and receiver to be effective for communication from a value of said SIR obtained in said SIR calculation means.

19. (Currently Amended) A communication quality measuring apparatus in CDMA cellular system detecting a reception chip timing of a channel to be measured and measuring communication quality, comprising:

time series generating means for generating two series of data consisted of a time series data of a detected value and a time series data delayed for one, two or more periods, with respect to said reception chip timing where the detected value becomes the same;

adding means for deriving an add vector from addition of received signal vector between two points close in reception timing when said two series data generated in said time series generating means becomes a particular correlation value;

subtracting means for deriving a difference vector from a difference of received signal vectors between two points close in reception timing;

second power calculation means for deriving a desired signal power and an interference signal power by averaging said add vectors and said difference vectors; and

signal to interference power ratio (SIR) calculating means deriving a SIR at said reception chip timing from said desired signal power and said interference signal power.

20. (Original) A communication quality measuring apparatus in CDMA cellular system as claimed in claim 19, which further comprises

third power calculation means for deriving an averaged desired signal power and an averaged interference signal power by performing averaging in a given period from said desired signal power and said interference signal power obtained in a first power calculation means and said second power calculation means.

21. (Original) A communication quality measuring apparatus in CDMA cellular system as claimed in claim 20, wherein when the channel to be measured is plural and only one correlation detector is useful,

said third power calculating means derives said averaged desired signal power and said average interference signal power in time division, and

said SIR calculation means derives said SIR of a plurality of channels in time division.

22. (Original) A communication quality measuring apparatus in CDMA cellular system as claimed in claim 19, wherein when the channel to be measured is plural and only one correlation detector is useful,

correlation detection of a plurality of channels is performed in time division for generating two series generated in the same reception chip timing per channel.

23. (Original) A communication quality measuring apparatus in CDMA cellular system as claimed in claim 22, which further comprises

fourth power calculation means for deriving an averaged desired signal power and an averaged interference signal power by averaging a given period from said desired signal power and said interference signal power obtained in said first power calculation means and a second power calculation means.

24. (Original) A communication quality measuring apparatus in CDMA cellular system as claimed in claim 19, which further comprises

path detection means for deriving a path between transmitter and receiver to be effective for communication from a value of said SIR obtained in said SIR calculation means.

25. (Original) A communication quality measuring method in CDMA cellular system detecting reception chip timing of channel to be measured repeatedly transmitted a transmission symbol series of a known pattern and performing measurement of communication quality, comprising:

correlation detection step of performing correlation detection of received signal using a code series spreading said channel to be measured;

delay step of delaying one of received series detected in said correlation detection step for one, two or more symbol period within a range where mutual correlation between transmission symbol series is 1 and influence of a propagation path can be regarded as the same;

vector calculation step of calculating difference vector and add vector from difference value and add value of respective received signal vectors of the same reception chip timing in the other received series detected by said correlation detection step and the received series provided delay in said delay step; and

communication quality calculation step of calculating a desired signal power, an interference signal power and SIR from said difference vector and said add vector calculated in said vector calculation step.

26. (Original) A communication quality measuring method in CDMA cellular system as claimed in claim 25, which further comprises

vector selection step of selecting only result of calculation at the same reception chip timing of received symbol matching respective transmission symbols among difference vector and add vector calculated in said vector calculation step when a correlation between the other

received series detected in said correlation detection step and the received series delayed in said delay step is smaller than one.

27. (Original) A communication quality measuring method in CDMA cellular system detecting reception chip timing of channel to be measured repeatedly transmitted transmission symbol series of respectively different known pattern using common spreading code from different antennas upon use of transmit diversity and performing measurement of communication quality, comprising:

correlation detection step of performing correlation detection of received signal using a code series spreading said channel to be measured;

delay step of delaying one of received series detected in said correlation detection step for one, two or more symbol period within a range where mutual correlation between transmission symbol series in said different antennas is 1 and influence of a propagation path can be regarded as the same;

vector calculation step of calculating difference vector and add vector from difference value and add value of respective received signal vectors of the same reception chip timing in the other received series detected by said correlation detection step and the received series provided delay in said delay step; and

communication quality calculation step of calculating a desired signal power, an interference signal power and SIR from said difference vector and said add vector calculated in said vector calculation step.

28. (Original) A communication quality measuring method in CDMA cellular system as claimed in claim 27, which further comprises

vector selection step of selecting only result of calculation at the same reception chip timing of received symbol matching respective transmission symbols of the different antenna among difference vector and add vector calculated in said vector calculation step when a mutual correlation between transmission symbol series in said different antenna is smaller than one.

29. (Original) A communication quality measuring apparatus in CDMA cellular system detecting reception chip timing of channel to be measured repeatedly transmitted a transmission symbol series of a known pattern and performing measurement of communication quality, comprising:

correlation detection means for performing correlation detection of received signal using a code series spreading said channel to be measured;

delay means for delaying one of received series detected in said correlation detection step for one, two or more symbol period within a range where mutual correlation between transmission symbol series is 1 and influence of a propagation path can be regarded as the same;

vector calculation means for calculating difference vector and add vector from difference value and add value of respective received signal vectors of the same reception chip timing in the other received series detected by said correlation detection step and the received series provided delay in said delay step; and

communication quality calculation means for calculating a desired signal power, an interference signal power and SIR from said difference vector and said add vector calculated in said vector calculation step.

30. (Original) A communication quality measuring apparatus in CDMA cellular system as claimed in claim 29, which further comprises

vector selection means for selecting only result of calculation at the same reception chip timing of received symbol matching respective transmission symbols among difference vector and add vector calculated in said vector calculation step when a correlation between the other received series detected in said correlation detection step and the received series delayed in said delay step is smaller than one.

31. (Original) A communication quality measuring apparatus in CDMA cellular system detecting reception chip timing of channel to be measured repeatedly transmitted transmission symbol series of respectively different known pattern using common spreading code from different antennas upon use of transmit diversity and performing measurement of communication quality, comprising:

correlation detection means for performing correlation detection of received signal using a code series spreading said channel to be measured;

delay means for delaying one of received series detected in said correlation detection step for one, two or more symbol period within a range where mutual correlation between transmission symbol series in said different antennas is 1 and influence of a propagation path can be regarded as the same;

vector calculation means for calculating difference vector and add vector from difference value and add value of respective received signal vectors of the same reception chip timing in the

other received series detected by said correlation detection step and the received series provided delay in said delay step; and

communication quality calculation means for calculating a desired signal power, an interference signal power and SIR from said difference vector and said add vector calculated in said vector calculation step.

32. (Original) A communication quality measuring apparatus in CDMA cellular system as claimed in claim 31, which further comprises

vector selection means for selecting only result of calculation at the same reception chip timing of received symbol matching respective transmission symbols of the different antenna among difference vector and add vector calculated in said vector calculation step when a mutual correlation between transmission symbol series in said different antenna is smaller than one.

33. (Original) For measuring communication quality in a mobile receiving station in a mobile communication system employing a CDMA cellular system, using channel spread with spreading code and constantly transmitted from a base station, a synchronization detecting method in CDMA cellular system comprising the step of:

in said mobile receiving station, determining a synchronization chip timing of a channel to be measured by detecting partial correlation value between spreading code to be measured and a received signal.

34. (Original) A synchronization detecting method in CDMA cellular system as claimed in claim 33, wherein a matched filter is used upon detection of said partial correlation

value and a synchronization chip timing of the channel to be measured is detected by sequentially rewriting the code in said matched filter.

35. (Original) A synchronization detecting method in CDMA cellular system as claimed in claim 34, wherein an averaging period and sampling period are preliminarily set in advance of performing said synchronization detection, and the synchronization chip timing of the channel to be measured is determined on the basis of a value derived by averaging of detected plurality of partial correlation values in said averaging period by detecting the partial detection values per set sampling period.

36. (Original) A synchronization detecting method in CDMA cellular system as claimed in claim 35, wherein upon averaging process of said detected plurality of partial correlation values, the synchronization chip timing of the channel to be measured is determined using an averaged value by preliminarily calculating said averaged value by power averaging process or vector averaging process.

37. (Original) A synchronization detecting method in CDMA cellular system as claimed in claim 36, wherein the synchronization chip timing of the channel to be measured is determined by enabling setting of process of said averaging process for a plurality of times and using the averaged value derived by a plurality of times of averaging process by the same or different averaging method in each process.

38. (Original) A synchronization detecting method in CDMA cellular system as claimed in claim 33, wherein an averaging period and sampling period are preliminarily set in advance of performing said synchronization detection, and the synchronization chip timing of the channel to be measured is determined on the basis of a value derived by averaging of detected plurality of partial correlation values in said averaging period by detecting the partial detection values per set sampling period.

39. (Original) A synchronization detecting method in CDMA cellular system as claimed in claim 38, wherein upon averaging process of said detected plurality of partial correlation values, the synchronization chip timing of the channel to be measured is determined using an averaged value by preliminarily calculating said averaged value by power averaging process or vector averaging process.

40. (Original) A synchronization detecting method in CDMA cellular system as claimed in claim 39, wherein the synchronization chip timing of the channel to be measured is determined by enabling setting of process of said averaging process for a plurality of times and using the averaged value derived by a plurality of times of averaging process by the same or different averaging method in each process.

41. (Original) A synchronization detecting method in CDMA cellular system comprising the steps of performing synchronization chip timing detection process for a plurality of times as defined in any one of claims 33 to 40, and making judgment whether synchronization chip timing of a channel to be measured is to be determined using an average value of a plurality

of timing value and a standard deviation value, the synchronization chip timing of the channel to be measured is determined with providing a given range, or synchronization detection is to be performed again.

42. (Original) For measuring communication quality in a mobile receiving station in a mobile communication system employing a CDMA cellular system, using channel spread with spreading code and constantly transmitted from a base station, a synchronization detecting device in CDMA cellular system comprising:

said mobile receiving station including means for determining a synchronization chip timing of a channel to be measured by detecting partial correlation value between spreading code to be measured and a received signal.

43. (Original) A synchronization detecting device in CDMA cellular system as claimed in claim 42, wherein said means includes a matched filter is used upon detection of said partial correlation value and a synchronization chip timing of the channel to be measured is detected by sequentially rewriting the code in said matched filter.

44. (Original) A synchronization detecting device in CDMA cellular system as claimed in claim 43, wherein said means preliminarily sets an averaging period and sampling period in advance of performing said synchronization detection, and determines the synchronization chip timing of the channel to be measured on the basis of a value derived by averaging of detected plurality of partial correlation values in said averaging period by detecting the partial detection values per set sampling period.

45. (Original) A synchronization detecting device in CDMA cellular system as claimed in claim 44, wherein upon averaging process of said detected plurality of partial correlation values, said means determines the synchronization chip timing of the channel to be measured using an averaged value by preliminarily calculating said averaged value by power averaging process or vector averaging process.

46. (Original) A synchronization detecting device in CDMA cellular system as claimed in claim 45, wherein said means determines the synchronization chip timing of the channel to be measured by enabling setting of process of said averaging process for a plurality of times and using the averaged value derived by a plurality of times of averaging process by the same or different averaging device in each process.

47. (Original) A synchronization detecting device in CDMA cellular system as claimed in claim 42, wherein said means preliminarily sets an averaging period and sampling period in advance of performing said synchronization detection, and determines the synchronization chip timing of the channel to be measured on the basis of a value derived by averaging of detected plurality of partial correlation values in said averaging period by detecting the partial detection values per set sampling period.

48. (Original) A synchronization detecting device in CDMA cellular system as claimed in claim 47, wherein upon averaging process of said detected plurality of partial correlation values, said means determines the synchronization chip timing of the channel to be

measured using an averaged value by preliminarily calculating said averaged value by power averaging process or vector averaging process.

49. (Original) A synchronization detecting device in CDMA cellular system as claimed in claim 48, wherein said means determines the synchronization chip timing of the channel to be measured by enabling setting of process of said averaging process for a plurality of times and using the averaged value derived by a plurality of times of averaging process by the same or different averaging device in each process.

50. (Original) A synchronization detecting device in CDMA cellular system comprising means for performing synchronization chip timing detection process for a plurality of times as defined in any one of claims 42 to 49, and making judgment whether synchronization chip timing of a channel to be measured is to be determined using an average value of a plurality of timing value and a standard deviation value, the synchronization chip timing of the channel to be measured is determined with providing a given range, or synchronization detection is to be performed again.

51. (Original) In a mobile communication system employing CDMA cellular system using a common pilot channel constantly transmitted from a base station in a mobile communication system upon use of transmit diversity for measuring communication quality in a mobile station being measured, a synchronization detecting method in CDMA cellular system comprising:

said mobile station separating received signal vector obtained by correlation detection of received signal per symbol into received signal vector per transmission antenna by performing addition and subtraction before and after symbol, and determining synchronization chip timing on the basis of a value derived by addition of the received signal vector in power.

52. (Original) A synchronization detecting method in CDMA cellular system as claimed in claim 51, wherein the synchronization chip timing is determined on the basis of a value derived by addition of an average vector derived by averaging received signal vector per each of a plurality transmission antenna obtained over a plurality of period with taking a unit where symbol pattern of signals transmitted from a plurality of transmission antenna becomes orthogonal between antennas.

53. (Original) A synchronization detecting method in CDMA cellular system determining synchronization chip timing on the basis of a value derived by performing synchronization chip timing detection process defined in claim 51 or 52 for a plurality of times and performing addition of obtained plurality of power.

54. (Original) In a mobile communication system employing CDMA cellular system using a common pilot channel constantly transmitted from a base station in a mobile communication system upon use of transmit diversity for measuring communication quality in a mobile station being measured, a synchronization detecting device in CDMA cellular system comprising:

said mobile station includes means for separating received signal vector per separating received signal vector obtained by detecting correlation per symbol by performing addition and subtraction before and after symbol, and determining synchronization chip timing on the basis of a value derived by addition of the received signal vector in power.

55. (Original) A synchronization detecting device in CDMA cellular system as claimed in claim 54, wherein said means determines the synchronization chip timing on the basis of a value derived by addition of an average vector derived by averaging received signal vector per each of a plurality transmission antenna obtained over a plurality of period with taking a unit where symbol pattern of signals transmitted from a plurality of transmission antenna becomes orthogonal between antennas.

56. (Original) A synchronization detecting device in CDMA cellular system determining synchronization chip timing on the basis of a value derived by performing synchronization chip timing detection process defined in claim 54 or 55 for a plurality of times and performing addition of obtained plurality of power.

57. (Original) In a mobile communication system employing CDMA cellular system using a common pilot channel constantly transmitted from a base station in a mobile communication system upon use of transmit diversity for measuring communication quality in a mobile station being measured, a communication quality measuring method in CDMA cellular system comprising:

in said mobile station, received signal vector obtained by correlation detection of received signal per symbol being separated into received signal vector per transmission antenna by performing addition and subtraction before and after symbol, and

a desired signal power, an interference signal power and SIR being calculated by deriving add vector and difference vector of two received signal vectors spaced for a plurality of symbol periods per transmission antenna, and performing averaging process of said add vector and said difference vector.

58. (Original) A communication quality measuring method in CDMA cellular system as claimed in claim 57, wherein said add vector and said difference vector are derived from the received signal vector of one transmission antenna and said desired signal power, said interference signal power and SIR are derived by adding a predetermined correction value.

59. (Original) A communication quality measuring method in CDMA cellular system as claimed in claim 58, wherein said desired signal power and said interference signal power are averaged, and said desired signal power, said interference signal power and SIR are calculated by adding a predetermined correction value.

60. (Original) In a mobile communication system employing CDMA cellular system using a common pilot channel constantly transmitted from a base station in a mobile communication system upon use of transmit diversity for measuring communication quality in a mobile station being measured, a communication quality measuring apparatus in CDMA cellular system comprising:

said mobile station includes means for receiving received signal vector obtained by correlation detection of received signal per symbol being separated into received signal vector per transmission antenna by performing addition and subtraction before and after symbol, and calculating a desired signal power, an interference signal power and SIR by deriving add vector and difference vector of two received signal vectors spaced for a plurality of symbol periods per transmission antenna, and performing averaging process of said add vector and said difference vector.

61. (Original) A communication quality measuring apparatus in CDMA cellular system as claimed in claim 60, wherein said means derives said add vector and said difference vector from the received signal vector of one transmission antenna and derives said desired signal power, said interference signal power and SIR by adding a predetermined correction value.

62. (Original) A communication quality measuring apparatus in CDMA cellular system as claimed in claim 61, wherein said means averages said desired signal power and said interference signal power, and calculates said desired signal power, said interference signal power and SIR by adding a predetermined correction value.